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SUMMARY REPORT GROUNDWATER QUALITY IN THE VICINITY OF THE PASCO SANITARY LANDFILL

JULY, 1983

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INTRODUCTION

The purpose of this report is to update the information on groundwater quality at the Pasco Sanitary Landfill. The report is prepared as part of the ongoing monitoring program at the site.

Groundwater monitoring wells were installed and sampled in January of 1982 and quarterly sampling, analysis and evaluation of these wells has been conducted through March of 1983. This report summarizes the data gathered to date, presents the results of statistical analysis of this data, and provides the rationale for future monitoring activity.

MONITORING WELL LOCATIONS AND CONSTRUCTION

The location of each of the installed monitoring wells is shown on Figure 1.

The elevation and construction of each of the monitoring wells are shown in Figures 2-6. The wells were all constructed to take water from only the upper 20 feet of the groundwater table. This should represent a worse case condition since any potential or existing leachate would become less concentrated the more it is diluted as it disperses deeper into the aquifer.

The casing for each well is two-inch PVC pipe. Screw joints were used below the water table to avoid possible organic contamination from pipe glue. Joints above this water table were glued. Bentonite seals were placed at the surface, 20 feet below grade, and just above the water table to prevent surface moisture from traveling down the bore hole. Two screens were placed in each well so packers could be used in the future to allow sampling at two different depths.

Figure 7 illustrates the construction of a new water supply well located adjacent to Well 3.

DIRECTION OF GROUNDWATER MOVEMENT

Groundwater elevations have been measured at each of the monitoring wells whenever samples have been taken and groundwater contours have been provided in earlier reports. However, with the drilling of Well #4 a more accurate estimation of the actual groundwater flow beneath the landfill site can now be determined. Figure #8 illustrates the groundwater contours as determined over the 29th and 30th of December, 1982. With the additional information provided by Well #4, measurements relatively close to the center line of the down-gradient flow at the area of interest are now available. Figure 9 illustrates the location of the waste sites and groundwater contours relative to surface features.

Prior to the drilling of Well #4, the closest observation North of Well #3 was more than 3300 feet distant, at Well #8. The contours illustrate the fact that the groundwater gradient is steepest North and East of Well #3 i.e.; the contour lines are closer together between the Control Well and Well #3 than they are between Well #3 and Well #5. The direction of flow is perpendicular to the contour lines. The figure also illustrates that the four down gradient wells (1, 2, 3, and 4) are properly placed to detect any leachate from the sewage lagoons, industrial waste disposal sites or solid waste fill activities.

It is interesting to note the impact of the water supply well upon the groundwater contours. Note the "bend" in the groundwater contours adjacent to and Southwest of the water supply well. The significance of this impact is that any plume generated from the sewage lagoons would probably travel in a Southwest direction until encountering the influence of the water supply well and then be pulled gently more westwardly.

GROUNDWATER SAMPLING TECHNIQUES

A small diameter Model 0500 Geo-Filter submersible pump was used to sample each well. The pump is of stainless steel and Teflon construction. Through the use of a fill bladder and a unique arrangement of valves, the collected sample does not come in contact with the atmosphere until it reaches the well head. Each well was pumped until at least 3 casing volumes (the quantity of water standing in the casing) were removed after which the samples were taken. The pH of the water was measured immediately in the field and all other analyses were conducted in the laboratory. All analytical work was done in accordance with EPA approved methods.

Samples were collected from the Control Well, Well #1, Well #2, and Well #3 in January '82, April '82, September '82, December '83 and March '83. Well #4 was not installed until 11-29-82, therefore, it was sampled only in December '82 and March '83.

APPLICABLE GROUNDWATER STANDARDS

The State of Washington has a Non-Degradation Policy as cited by RCW 90.48 and Chapter 173-301 of the Washington Administrative Code. The State Non-Degradation Policy attempts to avoid any significant deterioration of existing water quality. Since the state documents do not have quantitative chemical criteria, the groundwater at Pasco was compared to the criteria cited in the Environmental Protection Agency Regulation, Criteria for Classification of Solid Waste Disposal Facilities and Practices, 40 CFR 257. This document provides the most quantitative guidance for groundwater at solid waste disposal sites. It cites primary (health effect limitations) and secondary (non-health) related limitations. Health effect limitations are directed at protecting human health. The non-health effect limitations "are designed to protect groundwater from odor, discoloration, and taste causing contaminants. The comparison of Groundwater quality in the vicinity of the Pasco Sanitary Landfill to the EPA limitations is provided in the next two sections.

Part 257.3-4 requires that "a solid waste facility or practice shall not contaminate an underground drinking water source at the solid waste boundary." 40 CFR 141 Regulations were written to provide health effect standards. "Contamination" is defined as "the introduction of listed substances to groundwater so as to cause: (1) the concentration of the substance in the groundwater to exceed the maximum contaminant level specified; or (2) an increase in the concentration of the substance in the groundwater where the existing concentration of the substance exceeds the specified maximum contaminant level." However, the

preamble to 40 CFR 257 states that the purpose of using the primary drinking water standards as criteria is to "provide the basis for determining whether solid waste disposal facilities or practices pose no reasonable probability of adverse effects on health or the environment." The maximum contaminant levels were picked such that water containing lesser quantities of the materials should pose no adverse threat to human health or the environment.

COMPARISON OF GROUNDWATER QUALITY TO HEALTH EFFECT LIMITS

The upgradient control well (unaffected by landfill operations) and the down gradient wells 1-3 were sampled on February 17 and 18, 1982. Well #4 was installed later and was sampled December 29, 1982. The results of this effort are presented in Table 1 below.

TABLE 1

EPA HEALTH EFFECT LIMITS AND CONCENTRATIONS OF MATERIALS IN GROUNDWATER AT THE PASCO LANDFILL

	Well 1	Well 2	Well 3	Well 4	Upgradient Control Well	EPA Allowable Contaminant Level
Arsenic*	<.01	<.01	<.01	<.010	<.01	.05
Barium*	<.1	<.1	<.1	<.5	<.1	1.0
Cadmium*	<.001	<.001	<.001	<.001	<.001	.01
Chromium*	<.005	<.005	<.005	<.005	<.005	.05
Lead*	<.005	<.005	<.005	<.005	<.005	.05
Mercury*	<.0005	<.0005	<.0005	<.0005	<.0005	.002
Nitrate (N)*	4.79	4.13	4.90	4.45	5.22	10.00
Selenium*	<.005	<.005	<.005	<.005	<.005	.01
Silver*	<.005	<.005	<.005	<.005	<.005	.05
Fluoride*	0.27	0.30	0.45	0.40	0.37	1.80
Coliform**	<2	<2	<2	--	<2	3
Lindane***	<.02	<.02	<.02	<.07	<.04	4
Endrin***	<.05	<.05	<.05	<.18	<.1	0.2
Methoxychlor***	<.1	<.1	<.1	<.90	<.2	100
Toxaphene***	<2	<2	<2	<.18	<4	5
2,4-D***	<5	<5	<5	<4	<10	100
Silvex***	<.5	<.5	<.5	<4	<1.0	10

*mg/l
**Organisms/100ml
***ug/l

The sampling results showed that these materials were, in large part, below detection limits, and in all cases were below allowable contaminant levels. Therefore, the solid waste disposal activities pose no reasonable probability of adverse effects on health or the environment.

COMPARISON OF GROUNDWATER QUALITY TO NON-HEALTH EFFECT LIMITS

Table 2 shows initial non-health effect results compared to EPA allowable contaminant levels. Chlorides, Color, Sulphate, Odor, pH, copper, and zinc were clearly not of concern and were therefore not analyzed in subsequent sampling. However, iron, manganese, and the total dissolved solid content of the groundwater were of high enough levels that subsequent sampling (plus duplicate analyses and statistical evaluation of the data) was needed to further define the status of the groundwater at this site.

TABLE 2

EPA Designated Contaminant Levels for Non-Health Effect Contaminants and Concentrations of these Materials in the Groundwater at the Pasco Sanitary Landfill

	Well 1	Well 2	Well 3	Well 4	Upgradient Control Well	EPA Allowable Contaminant Level
Chloride	28.9	26.4	25.6	28.0	26.0	250.0
Color	<5	<5	<5	<5	<5	15
Iron	1.6	0.61	0.35	0.70	0.49	.3
Manganese	0.11	0.07	<.01	0.02	0.04	.05
Sulphate	80.0	79.0	77.5	--	83.0	250.0
TDS	396	414	394	478	394	500.0
Odor	<1	<1	<1	--	<1	3
pH	7.80	7.90	7.95	7.80	7.80	6.5-8.5
Copper	<.01	<.01	<.01	<.01	<.01	1.0
Zinc	<.05	<.05	<.05	<.05	<.05	5.0

All of the non-health effect data for each well collected over the last year is tabulated in Tables #3 through #7. These tables depict each of the water quality parameters for each of the individual sampling periods. In addition, EPA limits are shown for reference along with the mean and standard deviation of each data set. Perhaps the most important character here is the standard deviation value. As a general rule, a mean plus or minus 1 standard deviation will contain approximately 68% of the measurements in a normally distributed population. The mean plus or minus 2 deviations will contain approximately 95% of the measurements in a normal distribution. These considerations are helpful in spotting erroneous data.

In addition to the tables cited in the text, a statistical evaluation has been conducted to compare the means between

like parameters at different locations. This statistical evaluation is the Students "T" Test. The test is useful for comparing two sample means to determine if they are statistically different. The level of significance chosen for this evaluation was 95%, indicating that the probability of making an error in judgment i.e., concluding that the two means were different when, in fact, they were the same, is only five chances in one hundred. These statistical evaluations are listed as Appendix 1.

The only instances where there were statistically significant differences between the means at the control well and at other locations occurred among the manganese concentrations at wells #1, #2, #3 and the total dissolved solids concentration at well #4. For all other parameters there was no significant statistical difference between the means (averages) at the control and the down-gradient wells.

° IRON AND MANGANESE

Mean Iron Concentrations were higher than the recommended EPA Allowable Limits at the Control Well, Well #1, Well #3 and Well #4. It cannot be concluded that these iron concentrations are from fill or waste disposal activities since iron concentrations are highest at the upgradient control well. Iron concentrations are high enough that they could cause taste and staining concerns but these concentrations are felt to be reflective of soil conditions in the area.

Individual manganese concentrations have exceeded the EPA Allowable Concentrations, but the average concentrations are all below the allowable limits where taste and staining would be a concern. Iron and manganese limits have been established because waters containing more than 0.3 mg/l iron and 0.05 mg/l of manganese have been reported to have objectional taste and staining properties. Iron and manganese limits have not been set because of health effect reasons.

° TOTAL DISSOLVED SOLIDS (TDS)

The mean concentration of Total Dissolved Solids was below the 500 mg/l allowable limit established by EPA at all wells except well #4. The 500 mg/l limit for total dissolved solids is a secondary limitation set to protect groundwater from odor, discoloration and taste causing concerns. It is not a health effect standard. The total dissolved content at well #4 is significantly different than the total dissolved solids at the control well. Although this elevation may be a result of fill activities, the total dissolved solids content is less than established EPA allowable levels and therefore should have no appreciable impact.

TABLE 3

CONCENTRATIONS (mg/l) OF NON-HEALTH EFFECT PARAMETERS AT THE CONTROL WELL

DATE	IRON	MANGANESE	TDS
JAN 82	49	.04	394
APR 82		.02	416
SEP 82	.4	.01	416
DEC 82	2.1	.11	454
MAR 83	.39	.01	412
AVERAGE	.845	.038	418.4
E.P.A. MAXIMUM ALLOWABLE CONC.	.3	.05	500
SUM	3.38	.19	2092
SUM OF SQ	4.962200	.0143000	877208.0
# OF OBS	4	5	5
MEAN	.845	.038	418.4
VARIANCE	.7020333	.0017700	478.8000
STD DEV	.8378743	.0420714	21.88150

TABLE 4

CONCENTRATIONS (mg/l) OF NON-HEALTH EFFECT PARAMETERS AT WELL NUMBER 1

DATE	IRON	MANGANESE	TDS
JAN 82	1.6	.11	396
APR 82		.01	422
SEP 82	.16	.01	440
DEC 82	.58	.04	440
MAR 83	.19	<.01	412
AVERAGE	.6325	.0425	422
E.P.A. MAXIMUM ALLOWABLE CONC.	.3	.05	500
SUM	2.53	.17	2110
SUM OF SQ	2.958100	.0139000	891844.0
# OF OBS	4	4	5
MEAN	.6325	.0425	422
VARIANCE	.4526250	.0022250	355.9999
STD DEV	.6727741	.0471699	18.86796

TABLE 5

CONCENTRATIONS (mg/l) OF NON-HEALTH EFFECT PARAMETERS AT WELL NUMBER 2

DATE	IRON	MANGANESE	TDS
JAN 82	.61	.07	414
APR 82		.02	430
SEP 82	.13	.03	452
DEC 82	.18	<.01	444
MAR 83	.09	<.01	422
AVERAGE	.2525	.04	432.4
E.P.A. MAXIMUM ALLOWABLE CONC.	.3	.05	500
SUM	1.01	.12	2162
SUM OF SQ	.4295000	.0062000	935820.0
# OF OBS	4	3	5
MEAN	.2525	.04	432.4
VARIANCE	.0581583	7.000E-4	242.7998
STD DEV	.2411604	.0264575	15.58204

TABLE 6

CONCENTRATIONS (mg/l) OF NON-HEALTH EFFECT PARAMETERS AT WELL NUMBER 3

DATE	IRON	MANGANESE	TDS
JAN 82	.35	<.01	394
APR 82		<.01	352
SEP 82	.75	.02	428
DEC 82	.16	<.01	416
MAR 83	.15	<.01	404
AVERAGE	.3525	.02	398.8
E.P.A. MAXIMUM ALLOWABLE CONC.	.3	.05	500
SUM	1.41	.02	1994
SUM OF SQ	.7331000	4.000E-4	798596.0
# OF OBS	4	1	5
MEAN	.3525	.02	398.8
VARIANCE	.0786917	ERROR	847.1999
STD DEV	.2805203	ERROR	29.10670

TABLE 7

CONCENTRATIONS (mg/l) OF NON-HEALTH EFFECT PARAMETERS AT WELL NUMBER 4

DATE	IRON	MANGANESE	TDS
JAN 82			
APR 82			
SEP 82			
DEC 82	.7	.02	478
MAR 83	.66	.02	560
JUNE 83	<0.05	<0.01	440
AVERAGE	.68	.02	493
E.P.A. MAXIMUM ALLOWABLE CONC.	.3	.05	500
SUM	1.36	.04	1478
SUM OF SQ	.9256000	8.000E-4	735684.0
# OF OBS	2	2	3
MEAN	.68	.02	492.6667
VARIANCE	8.000E-4	1.9E-13	3761.333
STD DEV	.0282843	4.359E-7	61.32971

INDICATOR PARAMETERS FOR GROUNDWATER QUALITY

Duplicate analyses and statistical evaluations were utilized to determine the relationships of the values associated with other water quality parameters not directly associated with 40 CFR 257 limitations. These parameters are nitrate, specific conductivity, phenol and total organic halogens. Tables 8-12 present these general water quality analysis results. The concentrations of these materials warranted additional evaluation because of specific disposal practices at the Pasco Sanitary Landfill. The reasons for the testing, and the conclusions based upon the results, are listed below:

° NITRATE

Nitrate concentrations were measured because elevated nitrates might be expected as a result of the sewage lagoon operation. There was no significant difference between the control and any downgradient well nitrate concentrations. All nitrate concentrations were well below the E.P.A. maximum allowable contaminant level of 10.0 mg/l. Therefore, it can be concluded that discharge from the sewage lagoon has had no appreciable impact on nitrate levels.

° PHENOL

Phenols were measured because they have been disposed of at the industrial waste sites and they can cause objectionable tastes and odors at concentrations as low as 0.03 mg/l.

The mean phenol concentrations at all wells was well below the EPA Allowable Concentrations set on the basis of taste and odor concerns.

° SPECIFIC CONDUCTIVITY

Specific Conductivity has been measured as a general indicator of the amount of dissolved solids (especially inorganic salts) at each of the monitoring wells. There is no specific standard for this parameter and there is no significant (statistically) difference between the specific conductivity at the control well and any of the other down gradient wells.

° TOTAL ORGANIC HALOGENS (TOX)

The total Organic Halogen content has been measured at each of the wells to determine the total quantity of organic halides present (as chloride) at each of the locations. Evaluations over the past five sampling periods indicate that there is no significant difference between mean concentrations of total organic halides at the control well and down gradient wells.

It should be noted that there has been a considerable amount of variability in the TOX results and this may be more meaningful than the results themselves. With the exception of well #4, each well has had a high concentration of TOX at one time or another. Because of this variability, spiked samples were submitted with the last round of sampling to determine the accuracy of the TOX analysis. Monochlorobezene was the compound selected as the spike compound 0.175 mg/l as chloride was spiked with the addition of Monochlorobezene to a separate control and well #3 sample. Table #13 shows the concentrations of materials determined by EAL Corporation Laboratories. The first column in the table indicates the concentrations in mg/l of TOX reported as chloride. The second column indicates that the percent recovery for the control and well #3 was 11.$ and 50.8% respectively. This means only 11% of the material present in the sample was detected at the control and only about 50% of the material present in the well #3 sample was detected. The laboratory was informed of this poor recovery and re-ran the samples. The re-runs on the samples indicate much better percentages of recovery. (The second round 94% and 110% of the material present being accounted for). However, the results seriously question the accuracy of previously performed TOX analysis in that only after the lab was challenged were the recoveries in an acceptable range. The significance of this information is that quality control spikes should be submitted with each of the TOX samples in the future.

Because the TOX results were higher than normal during the fourth quarter sampling at wells #2 and #3, separate samples were collected at these wells after the TOX results had become available. The separate samples were analyzed for the specific pesticides sited by EPA in 40 CFR 257. The results are shown in Table #14. Once again, wells #2 and #3 were well below the EPA Allowable Contaminant Levels.

TABLE 8

CONCENTRATIONS (mg/l) OF GENERAL WATER QUALITY PARAMETERS AT THE CONTROL WELL

DATE	NITRATE	SP COND	PHENOL	TOX
JAN 82	5.22		<.05	.02
APR 82	5.1	570	.0013	.09
SEP 82	4.1	610	<.0005	.11
DEC 82	4.88	555	<.001	.06
MAR 83	5.37	620	.0025	<.001
AVERAGE	4.934	588.75	.0019	.07
SUM	24.67	2355	.0038	.28
SUM OF SQ	122.7197	1389425.	7.940E-6	.0242000
# OF OBS	5	4	2	4
MEAN	4.934	588.75	.0019	.07
VARIANCE	.2494800	972.9167	7.200E-7	.0015333
STD DEV	.4994797	31.19161	8.485E-4	.0391578

TABLE 9

CONCENTRATIONS (mg/l) OF GENERAL WATER QUALITY PARAMETERS AT WELL NUMBER 1

DATE	NITRATE	SP COND	PHENOL	TOX
JAN 82	4.79		< .05	.01
APR 82	5.15	570	.0022	
SEP 82	4.76	620	.013	
DEC 82	4.95	515	.002	.05
MAR 83	5.06	620	< .001	.092
AVERAGE	4.942	581.25	.0057333	.0506667
SUM	24.71	2325	.0172	.152
SUM OF SQ	122.2303	1358925.	1.778E-4	.0110640
# OF OBS	5	4	3	3
MEAN	4.942	581.25	.0057333	.0506667
VARIANCE	.0283700	2506.250	3.961E-5	.0016813
STD DEV	.1684340	50.06246	.0062939	.0410041

TABLE 10

CONCENTRATIONS (mg/l) OF GENERAL WATER QUALITY PARAMETERS AT WELL NUMBER 2

DATE	NITRATE	SP COND	PHENOL	TOX
JAN 82	4.12		.1	.4
APR 82	4.31	590	.0032	.01
SEP 82	3.7	625	.0295	.14
DEC 82	4.25	515	.008	.58
MAR 83	5.06	620	< .001	.027
AVERAGE	4.288	587.5	.035175	.2314
SUM	21.44	2350	.1407	1.157
SUM OF SQ	92.90660	1388350.	.0109445	.5168290
# OF OBS	5	4	4	5
MEAN	4.288	587.5	.035175	.2314
VARIANCE	.2429700	2575.000	.0019985	.0622748
STD DEV	.4929199	50.74446	.0447041	.2495492

TABLE 11

CONCENTRATIONS (mg/l) OF GENERAL WATER QUALITY PARAMETERS AT WELL NUMBER 3

DATE	NITRATE	SP COND	PHENOL	TOX
JAN 82	4.9		<.05	.001
APR 82	5.2	570	.0022	
SEP 82	4.1	620	.0155	.16
DEC 82	4.5	555	<.001	.56
MAR 83	5.1	610	.003	.007
AVERAGE	4.76	588.75	.0069	.182
SUM	23.8	2355	.0207	.728
SUM OF SQ	114.1200	1389425.	2.541E-4	.3392500
# OF OBS	5	4	3	4
MEAN	4.76	588.75	.0069	.182
VARIANCE	.2080000	972.9167	5.563E-5	.0689180
STD DEV	.4560702	31.19161	.0074586	.2625224

TABLE 12

CONCENTRATIONS (mg/l) OF GENERAL WATER QUALITY PARAMETERS AT WELL NUMBER 4

DATE	NITRATE	SP COND	PHENOL	TOX
JAN 82				
APR 82				
SEP 82				
DEC 82	4.45	555	<.001	.05
MAR 83	4.68	890	.004	.073
JUNE 83	5.3	600		.012
AVERAGE	4.81	681.6667	.004	.045
SUM	14.43	2045	.004	.135
SUM OF SQ	69.79490	1460125.	1.600E-5	.0079730
# OF OBS	3	3	1	3
MEAN	4.81	681.6667	.004	.045
VARIANCE	.1933000	33058.33	ERROR	9.490E-4
STD DEV	.4396589	181.8195	ERROR	.0308058

TABLE 13 QUALITY CONTROL
OF TOTAL ORGANIC HALOGEN (TOX) RESULTS

	1st Run Mg/l of TOX (AS CHLORIDE)	1st Run % RECOVERY	2nd Run Mg/l of TOX (AS CHLORIDE)	2nd Run % RECOVERY
CONTROL WELL	.001			
CONTROL WELL +Spike (.175 mg/l)	.020	11.4%	.195	110.8%
WELL #3	.008			
WELL #3 +Spike (.175 mg/l)	.093	50.8%	.193	106.0%

TABLE 14
FIRST QUARTER 1983
PESTICIDE RESULTS (ppb) AT WELLS #2 AND #3

PESTICIDE	WELL #2	WELL #3	EPA ALLOWABLE CONTAMINANT LEVELS
2,4-D	0.06	0.04	100.0
2,4,5-TP	<0.01	<0.01	10
ENDRIN	<0.01	<0.01	0.2
LINDANE	<0.01	<0.01	4.0
METHOXYCHLOR	<0.1	<0.1	100.0
TOXPHENE	<0.1	<0.1	5.0

SUMMARY

The purpose of this report is to provide updated information on groundwater quality at the Pasco Sanitary Landfill. The report is prepared as part of the ongoing monitoring program at the site.

Groundwater monitoring wells were installed and sampled in January of 1982 and quarterly sampling, analysis, and evaluation of these wells has been conducted through June of 1983. This report summarizes the data gathered to date, presents the results of statistical analysis of this data, and provides the rationale for future monitoring activity. The major conclusions are:

1. Having developed groundwater contours over the past year it is concluded that the monitoring wells are properly placed to detect any leachate from industrial disposal sites, solid waste fill areas, and sewage lagoon operations. In addition, seasonal variations or pumping rates do not appear to appreciably affect groundwater flow.

2. The monitoring wells are all constructed to obtain water from the upper 20' of an aquifer which is 60-70' thick. Contaminants from the landfill would be most readily observed in the upper layer, becoming more dilute if the sample is drawn from a larger (i.e. deeper) portion of the aquifer.

3. Sampling results for all health-effect related parameters show these to be, in large part, below detection limits, and in all cases are below EPA allowable contaminant levels. Therefore, landfilling activities pose no reasonable probability of adverse effects upon human health.

4. Sampling results for non-health effect parameters (taste, color and odor causing materials) indicate the majority of these parameters are below EPA allowable contaminant levels.

   Iron, and at times manganese concentrations, have been above acceptable levels with concentrations high enough that these parameters could cause taste and staining problems if water were drawn from the upper 20 feet of the aquifer for domestic uses. The presence of iron and manganese at these levels is thought to occur naturally as a result of soils in the area and not waste management operations.

The total dissolved solids content of one down-gradient well (Well #4) is statisically higher than the control well and may be a result of fill activities. However, the concentration is less than EPA allowable levels and

therefore would not have any appreciable impact.

5. As a result of this program to date, a modified sampling schedule appears appropriate. The site water supply well will be monitored quarterly for coliforms and the frequency for monitoring all other wells will be reduced to once/year.

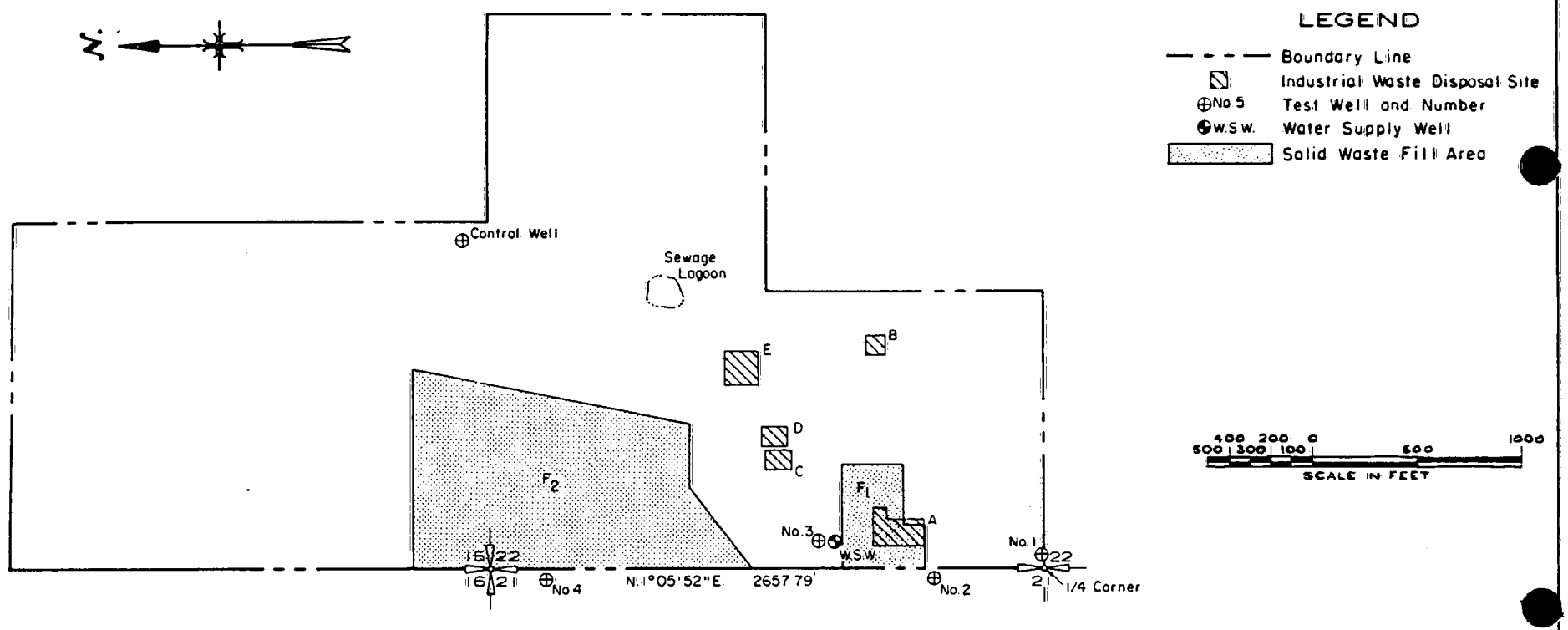


FIGURE 1

PASCO SANITARY LANDFILL

WASTE DISPOSAL AND WELL LOCATIONS

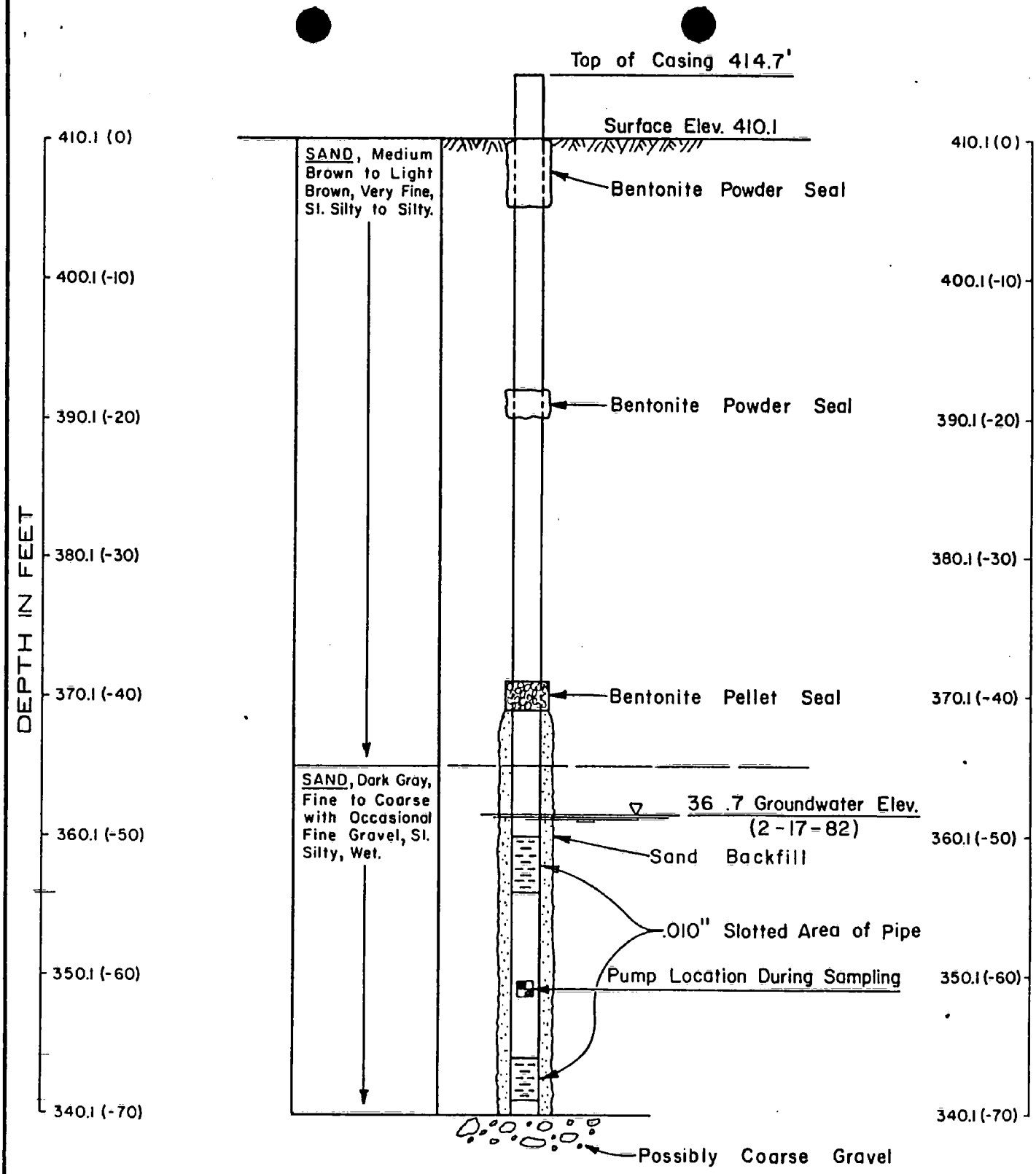


FIGURE 2

CONTROL WELL

INSTALLED 1-13-82

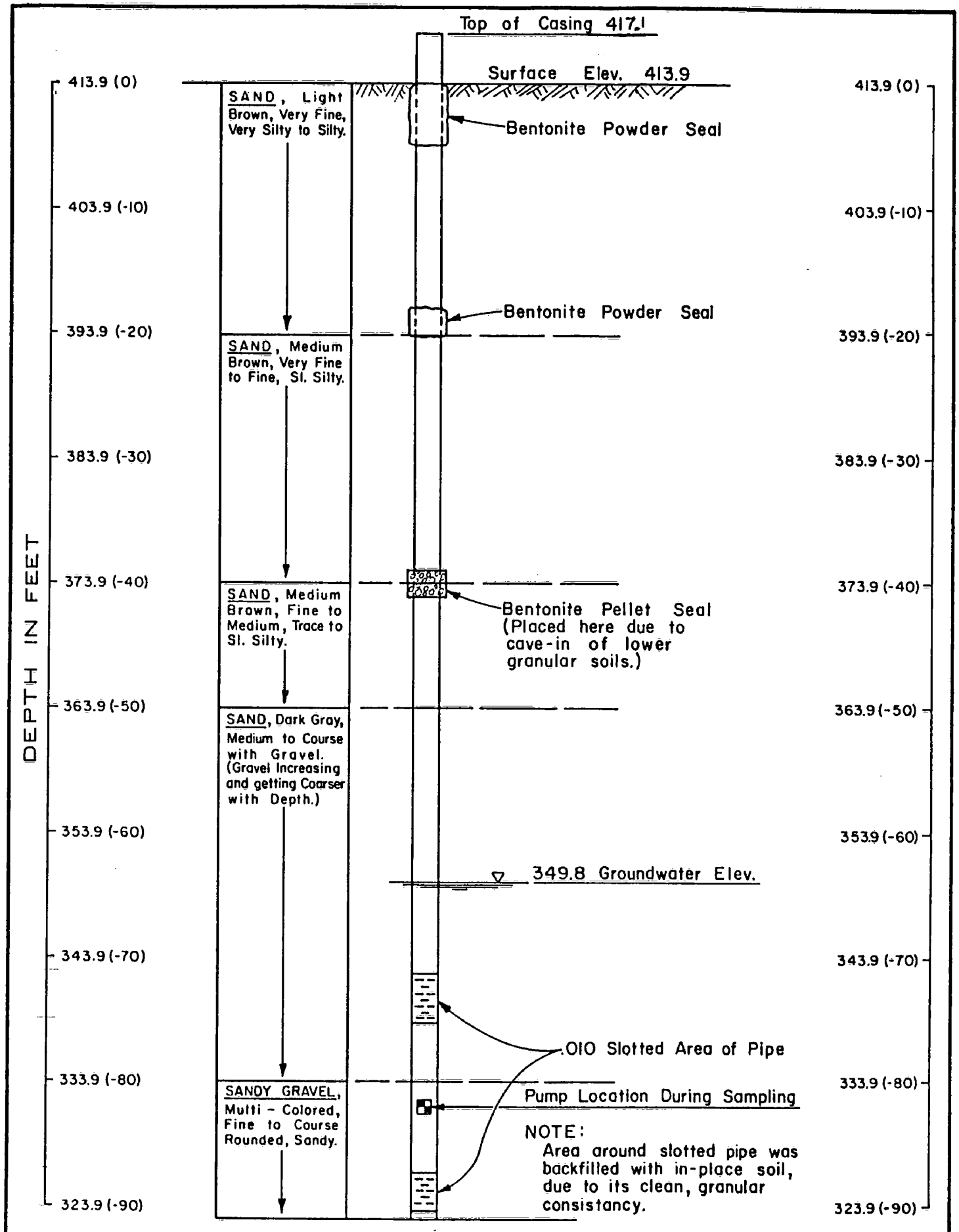


FIGURE 3.6

WELL NO. 1

INSTALLED 1-15-82

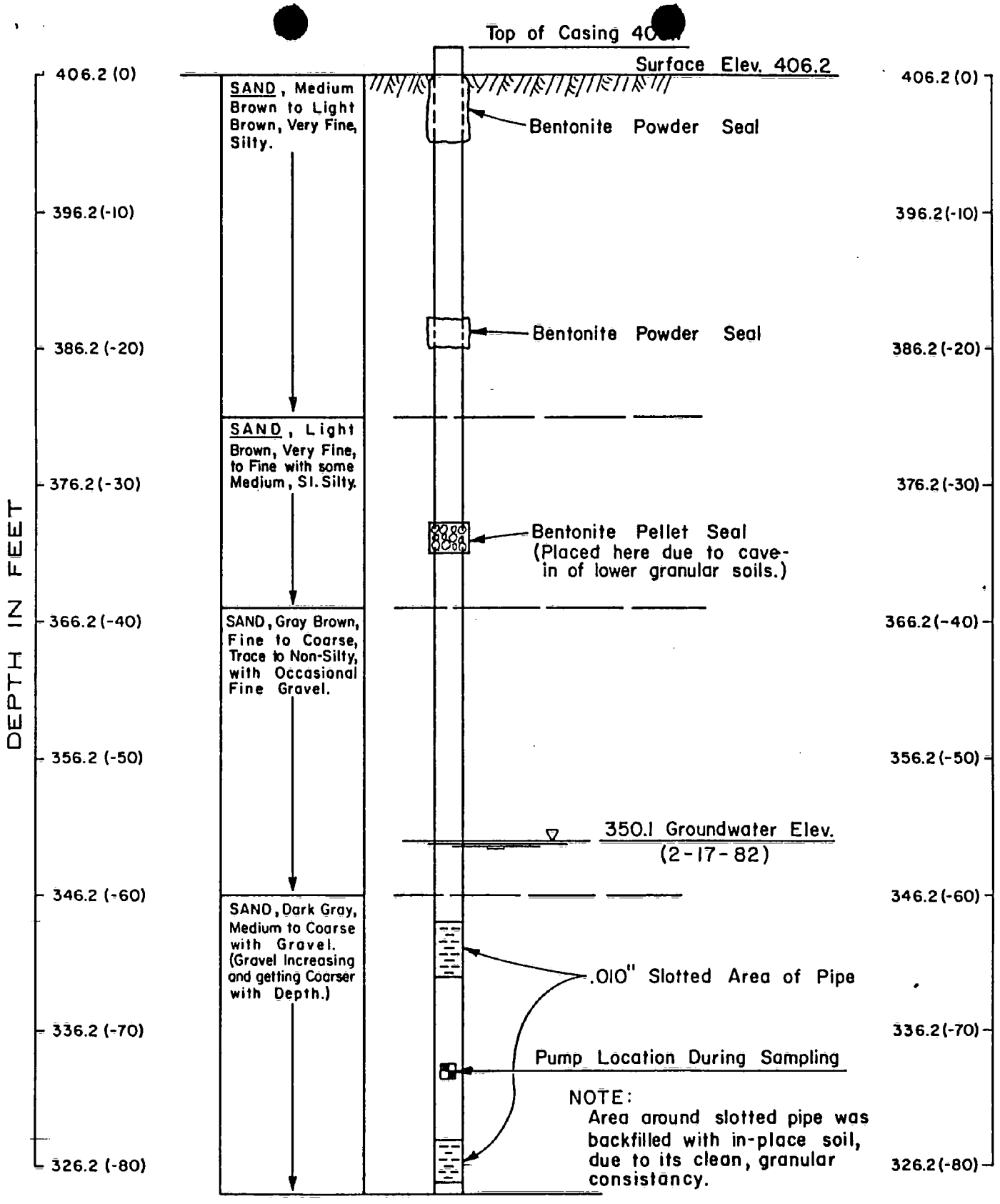


FIGURE 4

WELL NO. 2

INSTALLED 1-14-82

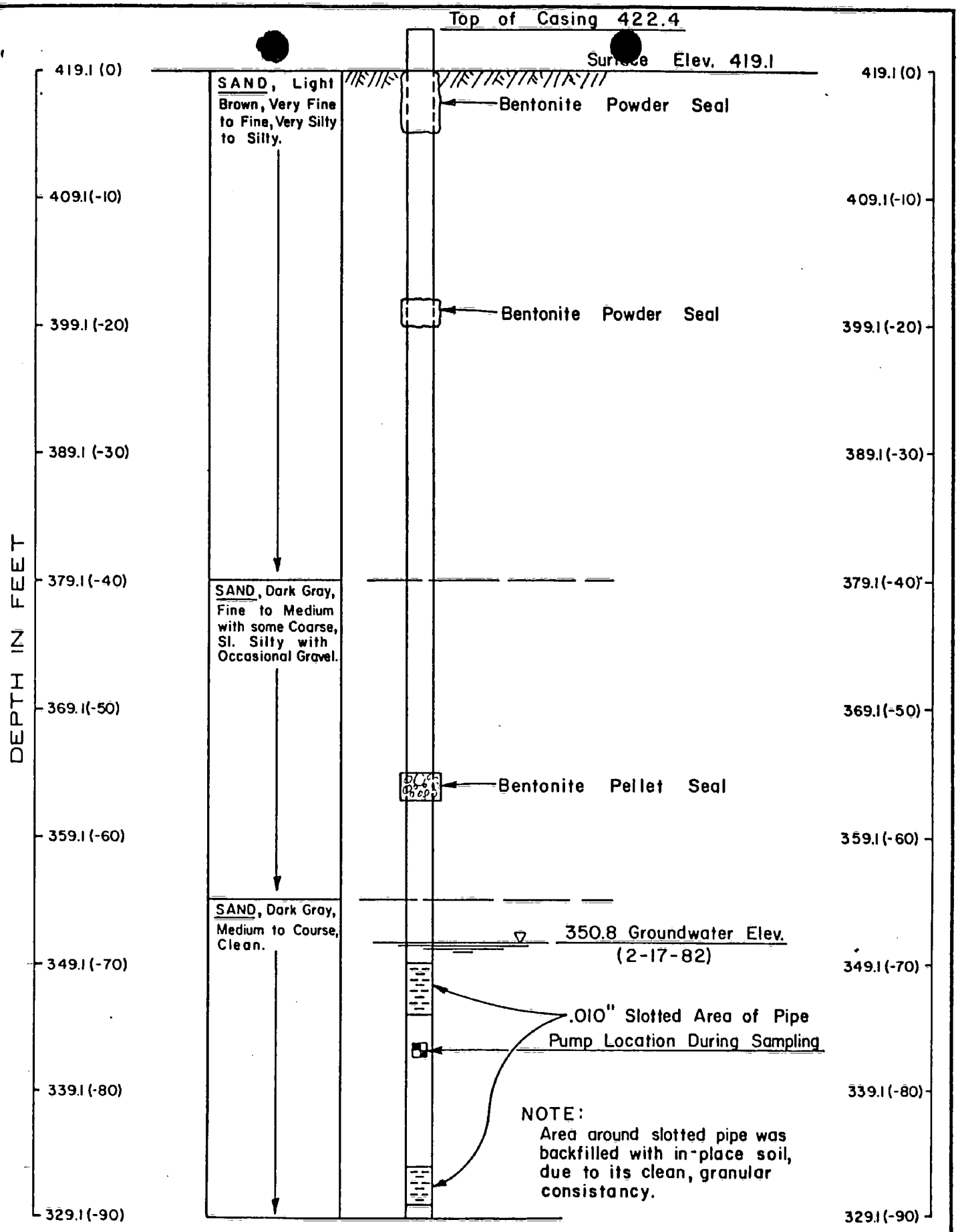
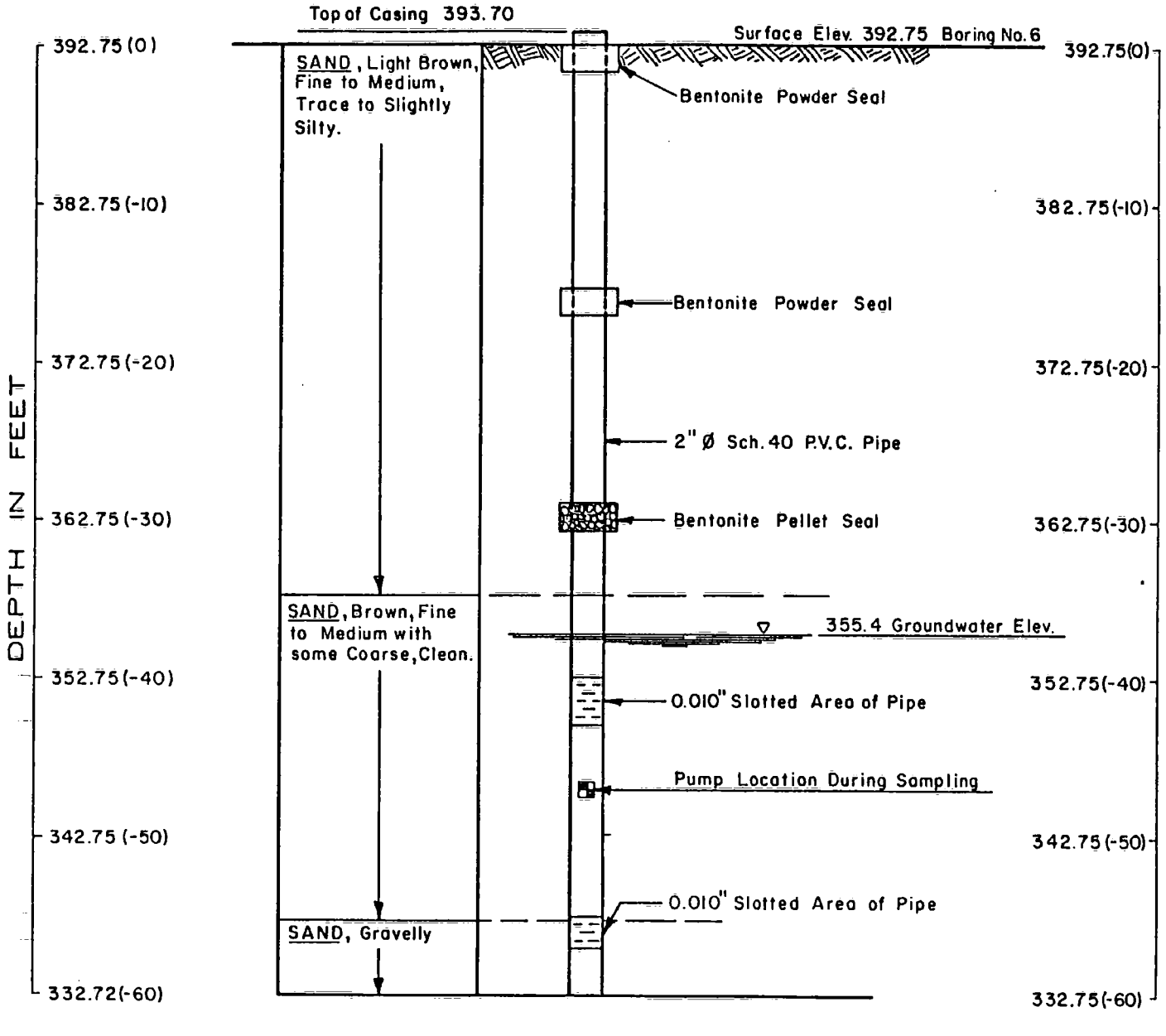


FIGURE 5

WELL NO. 3

INSTALLED 1-16-82



NOTE:
Area around slotted pipe was backfilled with in-place soil, due to it's clean, granular consistency.

FIGURE 6

WELL NO.4

INSTALLED 11-29-82

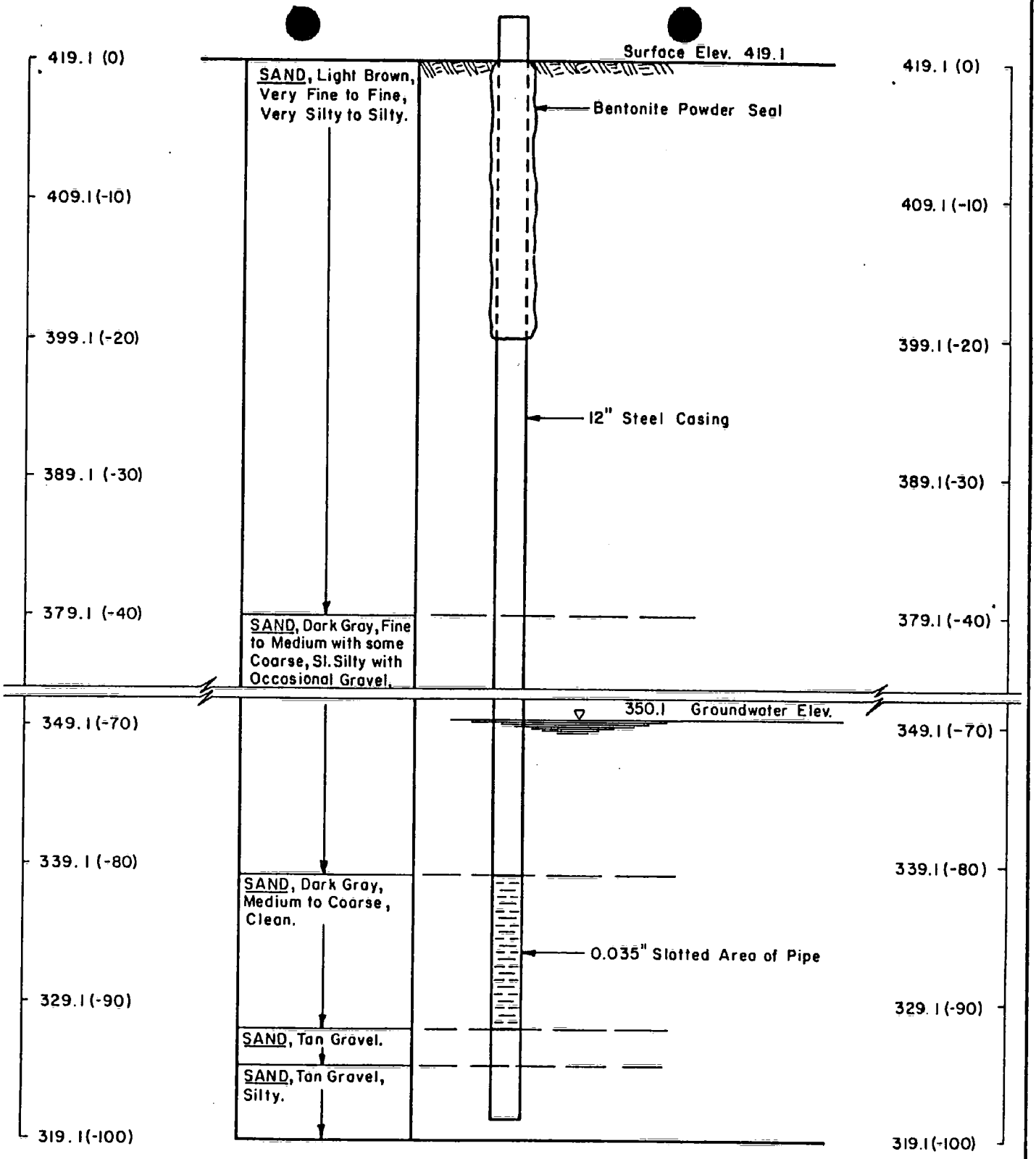


FIGURE 7

WATER SUPPLY WELL

INSTALLED 9-28-82

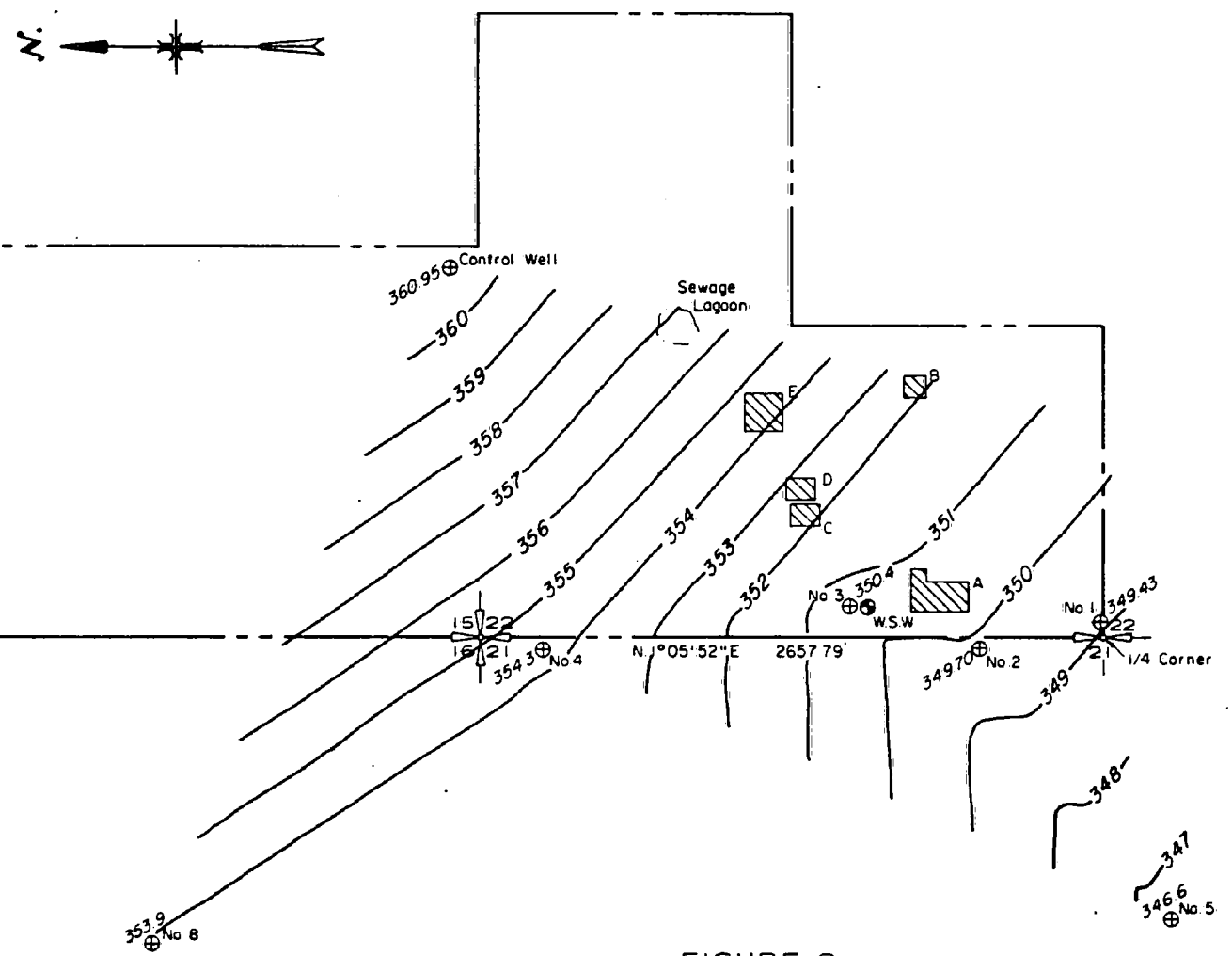


FIGURE 8

PASCO SANITARY LANDFILL

GROUNDWATER ELEVATIONS

12/29/82-12/30/82

Larry - can you eliminate the photo in areas I have marked? on you then put all of the legend info + the figure wording on a white background that is more figure wording above the figure or more figure up so figure wording is whether it is now but figure is above it.

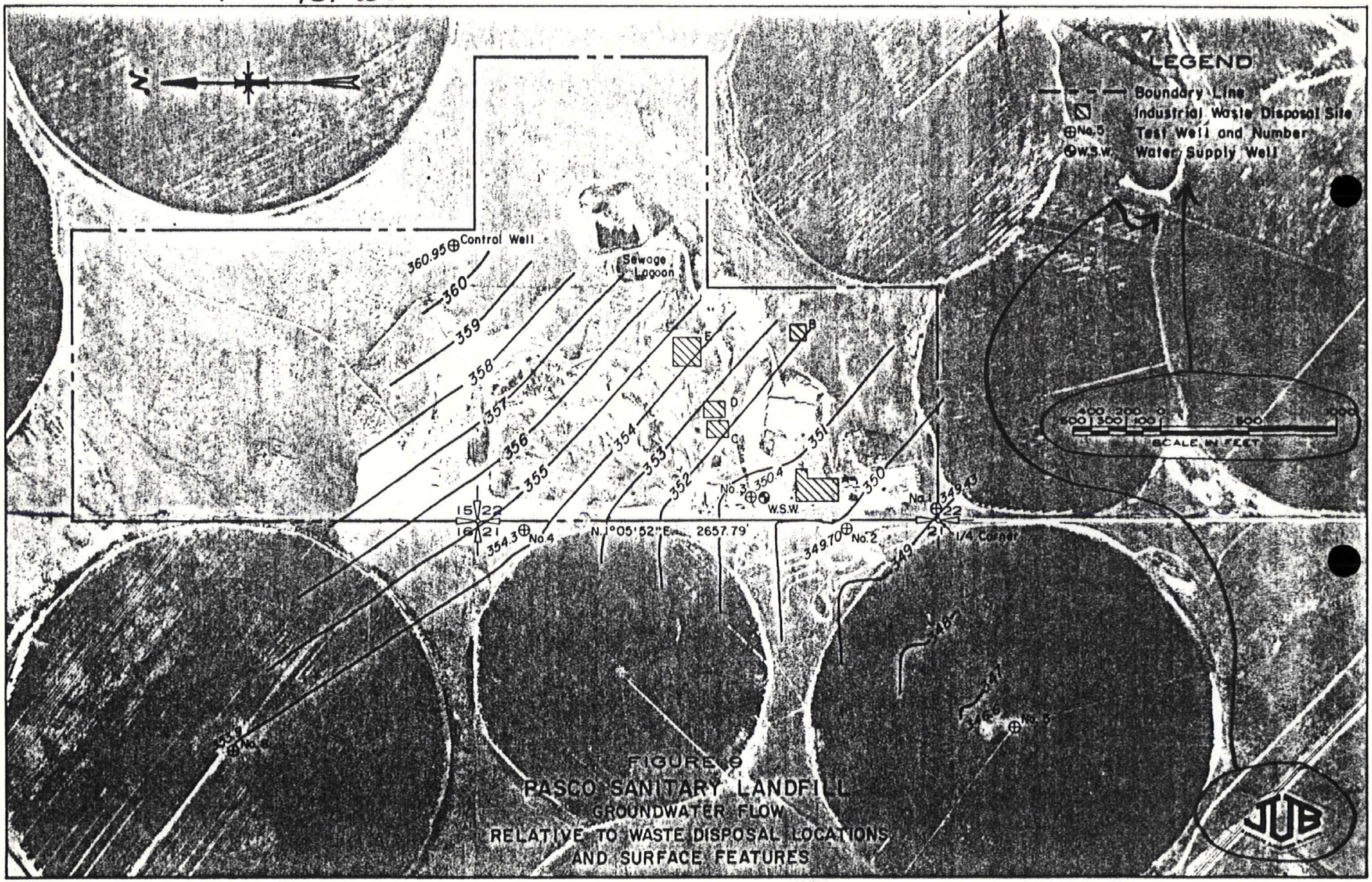


FIGURE 9
PASCO SANITARY LANDFILL
GROUNDWATER FLOW
RELATIVE TO WASTE DISPOSAL LOCATIONS
AND SURFACE FEATURES

JUB

A P P E N D I X 1

CONTROL WELL

#1 screen 410.1 − 356.1 = 54 feet bottom of top screen — Sample collected 54 ↔ 66 ft

#2 410.1 − 344.1 = 66 feet top of bottom screen

WELL #1

#1 screen 413.9 − 338.9 = 75 — Sample collected 75 ↔ 88 ft

#2 screen 413.9 − 325.9 = 88

WELL #2

#1 screen 406.2 − 339.2 = 67 — Sample collected 67 ↔ 78 ft.

#2 screen 406.2 − 328.2 = 78

WELL #3

#1 screen 419.1 − 345.1 = 74 — Sample collected 74 ↔ 86 ft

#2 screen 419.1 − 333.1 = 86

WELL #4

#1 screen 392.75 − 349.75 = 43 — sample collected 43 ↔ 55'

#2 392.75 − 337.75 = 55

WATER Supply Well

#1 screen 419.1 − 328.1 = 91' above screen

gw. elev. 350.1 = 69 — 69 ↔ 91'

EE-1

Screened interval - 66-88'

static H_2O level - 59.2

Sample - 59.2 - 66'

EE-2

Screened 64-86'

static H_2O level 68.5

Sample ~ 68'

EE-3

Screened 65-87'

static H_2O level 62'

Sample 62 - 65'

EE4

Screened interval 48 - 70'

Static H_2O level 43.5'

Sample 43.5 → 48'

EE5

Screened interval 50-72'

Static water level 51'

Sample ~ 51'

EE6

Screened 77.5 - 99.5'

Static H_2O level 70.3

Sample 70.3 - 72.5

EE7 Screened 78 - 100'

Static H_2O level 73.2

Sample 73.2 - 78'

EE-8

Screened 78 - 100'

Static H_2O level 77.4

Sample 77 - 78'

EE-9

Screened 75 - 97

Static H_2O level 75'

Sample ~ 75

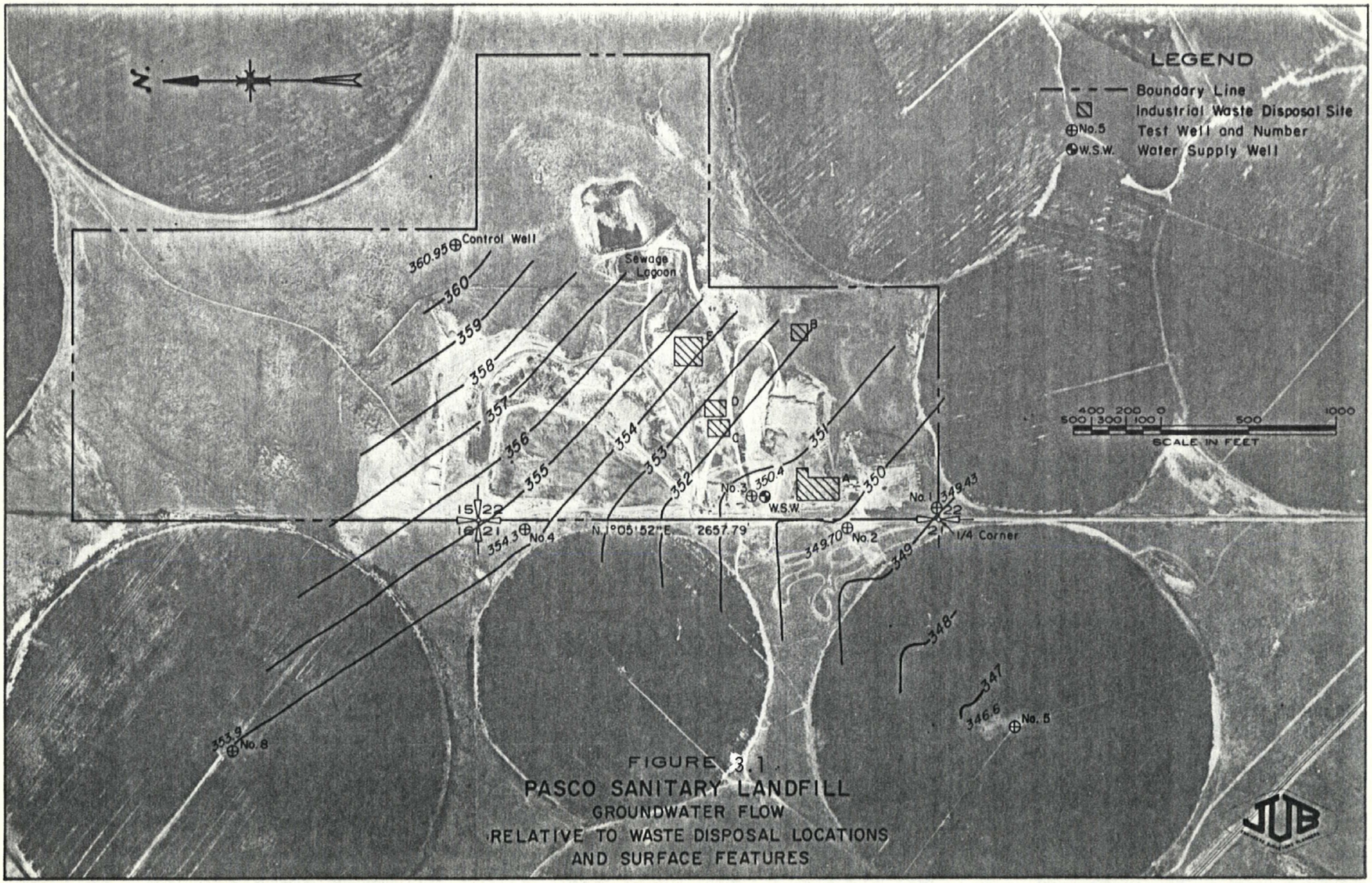


FIGURE 3.1.
PASCO SANITARY LANDFILL
GROUNDWATER FLOW
RELATIVE TO WASTE DISPOSAL LOCATIONS
AND SURFACE FEATURES

A P P E N D I X 1

```
**********************************************************************************

GROUP A =CONTROL   IRON                    |     null hypothesis is
         # OF OBS=          4              |     that group A = group B
         VARIANCE=       .702              |
         MEAN     =       .845              |reject (calc > table) ?    FALSE
                                            |reject (calc < table) ?    FALSE
GROUP B =WELL 1    IRON                    |
         # OF OBS=          4              |     if any "TRUE" values appear
         VARIANCE=       .453              |     then group A does NOT equal
         MEAN     =       .633              |     group B statistically
-----------------------------------------   |
pooled estimator =      .5775              |     if both conditions appear
degree of freedom=          6              |     "FALSE",then you cannot
    t values from tables =       2.447     |     say that they are
    (two tailed t test)  =      -2.447     |     statistically different
    (1/n1)+(1/n2)=          .5             |
sqrt(1/n1)+(1/n2)=       0.71              |
sqrt(pooled est.)=       0.76              |
-----------------------------------------   |
     calculated "t" value = .3945253       |
-----------------------------------------   |
**********************************************************************************
**********************************************************************************

GROUP A =CONTROL   IRON                    |     null hypothesis is
         # OF OBS=          4              |     that group A = group B
         VARIANCE=       .702              |
         MEAN     =       .845              |reject (calc > table) ?    FALSE
                                            |reject (calc < table) ?    FALSE
GROUP B =WELL 2    IRON                    |
         # OF OBS=          4              |     if any "TRUE" values appear
         VARIANCE=       .058              |     then group A does NOT equal
         MEAN     =       .253              |     group B statistically
-----------------------------------------   |
pooled estimator =        .38              |     if both conditions appear
degree of freedom=          6              |     "FALSE",then you cannot
    t values from tables =       2.447     |     say that they are
    (two tailed t test)  =      -2.447     |     statistically different
    (1/n1)+(1/n2)=          .5             |
sqrt(1/n1)+(1/n2)=       0.71              |
sqrt(pooled est.)=       0.62              |
-----------------------------------------   |
     calculated "t" value = 1.358141       |
-----------------------------------------   |
**********************************************************************************
**********************************************************************************

GROUP A =CONTROL   IRON                    |     null hypothesis is
         # OF OBS=          4              |     that group A = group B
         VARIANCE=       .702              |
         MEAN     =       .845              |reject (calc > table) ?    FALSE
                                            |reject (calc < table) ?    FALSE
GROUP B =WELL 3    IRON                    |
         # OF OBS=          4              |     if any "TRUE" values appear
         VARIANCE=       .079              |     then group A does NOT equal
         MEAN     =       .353              |     group B statistically
-----------------------------------------   |
pooled estimator =      .3905              |     if both conditions appear
degree of freedom=          6              |     "FALSE",then you cannot
    t values from tables =       2.447     |     say that they are
    (two tailed t test)  =      -2.447     |     statistically different
    (1/n1)+(1/n2)=          .5             |
sqrt(1/n1)+(1/n2)=       0.71              |
sqrt(pooled est.)=       0.62              |
-----------------------------------------   |
     calculated "t" value = 1.113447       |
-----------------------------------------   |
**********************************************************************************
```

```
**********************************************************************

GROUP A =CONTROL  IRON                  |     null hypothesis is
         # OF OBS=          4           |     that group A = group B
         VARIANCE=       .702           |
         MEAN     =       .845          |reject (calc > table) ?    FALSE
                                        |reject (calc < table) ?    FALSE
GROUP B =WELL 4   IRON                  |
         # OF OBS=          2           |     if any "TRUE" values appear
         VARIANCE=      .0008           |     then group A does NOT equal
         MEAN     =        .68          |     group B statistically
-----------------------------------------
pooled estimator =      .5267           |     if both conditions appear
degree of freedom=          4           |     "FALSE",then you cannot
    t values from tables =      2.776   |     say that they are
    (two tailed t test)  =     -2.776   |     statistically different
    (1/n1)+(1/n2)=          .75         |
sqrt(1/n1)+(1/n2)=       0.87           |
sqrt(pooled est.)=       0.73           |
-----------------------------------------
     calculated "t" value = .2625256    |
-----------------------------------------
**********************************************************************
**********************************************************************

GROUP A =CONTROL  MANGANESE             |     null hypothesis is
         # OF OBS=          5           |     that group A = group B
         VARIANCE=     .00177           |
         MEAN     =        .38          |reject (calc > table) ?     TRUE
                                        |reject (calc < table) ?    FALSE
GROUP B =WELL 1   MANGANESE             |
         # OF OBS=          4           |     if any "TRUE" values appear
         VARIANCE=    .002225           |     then group A does NOT equal
         MEAN     =      .0425          |     group B statistically
-----------------------------------------
pooled estimator =    .001965           |     if both conditions appear
degree of freedom=          7           |     "FALSE",then you cannot
    t values from tables =      2.365   |     say that they are
    (two tailed t test)  =     -2.365   |     statistically different
    (1/n1)+(1/n2)=          .45         |
sqrt(1/n1)+(1/n2)=       0.67           |
sqrt(pooled est.)=       0.04           |
-----------------------------------------
     calculated "t" value = 11.34975    |
-----------------------------------------
**********************************************************************
**********************************************************************

GROUP A =CONTROL  MANGANESE             |     null hypothesis is
         # OF OBS=          5           |     that group A = group B
         VARIANCE=     .00177           |
         MEAN     =        .38          |reject (calc > table) ?     TRUE
                                        |reject (calc < table) ?    FALSE
GROUP B =WELL 2   MANGANESE             |
         # OF OBS=          3           |     if any "TRUE" values appear
         VARIANCE=      .0007           |     then group A does NOT equal
         MEAN     =        .04          |     group B statistically
-----------------------------------------
pooled estimator =    .0014133          |     if both conditions appear
degree of freedom=          6           |     "FALSE",then you cannot
    t values from tables =      2.447   |     say that they are
    (two tailed t test)  =     -2.447   |     statistically different
    (1/n1)+(1/n2)=       .5333333       |
sqrt(1/n1)+(1/n2)=       0.73           |
sqrt(pooled est.)=       0.04           |
-----------------------------------------
     calculated "t" value = 12.38389    |
-----------------------------------------
**********************************************************************
```

```
**********************************************************************

GROUP A =CONTROL   MANGANESE              |      null hypothesis is
         # OF OBS=          5             |      that group A = group B
         VARIANCE=     .00177             |
         MEAN     =        .38            |reject (calc > table) ?     TRUE
                                           |reject (calc < table) ?    FALSE
GROUP B =WELL 4    MANGANESE              |
         # OF OBS=          2             |      if any "TRUE" values appear
         VARIANCE=          0             |      then group A does NOT equal
         MEAN     =        .02            |      group B statistically
-------------------------------------     |
pooled estimator =    .001416             |      if both conditions appear
degree of freedom=          5             |      "FALSE",then you cannot
     t values from tables =       2.571   |      say that they are
     (two tailed t test)  =      -2.571   |      statistically different
     (1/n1)+(1/n2)=         .7            |
sqrt(1/n1)+(1/n2)=       0.84             |
sqrt(pooled est.)=       0.04             |
-------------------------------------     |
     calculated "t" value = 11.43462      |
-------------------------------------     |
**********************************************************************
**********************************************************************

GROUP A =CONTROL   NITRATE                |      null hypothesis is
         # OF OBS=          5             |      that group A = group B
         VARIANCE=     .24948             |
         MEAN     =      4.934            |reject (calc > table) ?     FALSE
                                           |reject (calc < table) ?     FALSE
GROUP B =WELL 1    NITRATE                |
         # OF OBS=          5             |      if any "TRUE" values appear
         VARIANCE=     .02837             |      then group A does NOT equal
         MEAN     =      4.942            |      group B statistically
-------------------------------------     |
pooled estimator =    .138925             |      if both conditions appear
degree of freedom=          8             |      "FALSE",then you cannot
     t values from tables =       2.306   |      say that they are
     (two tailed t test)  =      -2.306   |      statistically different
     (1/n1)+(1/n2)=         .4            |
sqrt(1/n1)+(1/n2)=       0.63             |
sqrt(pooled est.)=       0.37             |
-------------------------------------     |
     calculated "t" value = -.033937      |
-------------------------------------     |
**********************************************************************
**********************************************************************

GROUP A =CONTROL   NITRATE                |      null hypothesis is
         # OF OBS=          5             |      that group A = group B
         VARIANCE=     .24948             |
         MEAN     =      4.934            |reject (calc > table) ?     FALSE
                                           |reject (calc < table) ?     FALSE
GROUP B =WELL 2    NITRATE                |
         # OF OBS=          5             |      if any "TRUE" values appear
         VARIANCE=     .24297             |      then group A does NOT equal
         MEAN     =      4.288            |      group B statistically
-------------------------------------     |
pooled estimator =    .246225             |      if both conditions appear
degree of freedom=          8             |      "FALSE",then you cannot
     t values from tables =       2.306   |      say that they are
     (two tailed t test)  =      -2.306   |      statistically different
     (1/n1)+(1/n2)=         .4            |
sqrt(1/n1)+(1/n2)=       0.63             |
sqrt(pooled est.)=       0.50             |
-------------------------------------     |
     calculated "t" value = 2.058432      |
-------------------------------------     |
**********************************************************************
```

```
**********************************************************************

GROUP A =CONTROL  NITRATE                 |      null hypothesis is
         # OF OBS=          5             |      that group A = group B
         VARIANCE=     .24948             |
         MEAN     =     4.934             |reject (calc > table) ?     FALSE
                                           |reject (calc < table) ?     FALSE
GROUP B =WELL 3   NITRATE                 |
         # OF OBS=          5             |      if any "TRUE" values appear
         VARIANCE=       .208            |      then group A does NOT equal
         MEAN     =       4.76            |      group B statistically
-------------------------------------------
pooled estimator =     .22874             |      if both conditions appear
egree of freedom=          8             |      "FALSE",then you cannot
    t values from tables =       2.306    |      say that they are
    (two tailed t test)  =      -2.306    |      statistically different
    (1/n1)+(1/n2)=          .4           |
qrt(1/n1)+(1/n2)=        0.63            |
qrt(pooled est.)=        0.48            |
-------------------------------------------
     calculated "t" value = .5752388      |
-------------------------------------------
**********************************************************************
**********************************************************************

GROUP A =CONTROL  NITRATE                 |      null hypothesis is
         # OF OBS=          5             |      that group A = group B
         VARIANCE=     .24948             |
         MEAN     =     4.934             |reject (calc > table) ?     FALSE
                                           |reject (calc < table) ?     FALSE
ROUP B =WELL 4   NITRATE                  |
         # OF OBS=          3             |      if any "TRUE" values appear
         VARIANCE=       .1933           |      then group A does NOT equal
         MEAN     =       4.81            |      group B statistically
-------------------------------------------
ooled estimator =  .2307533               |      if both conditions appear
egree of freedom=          6              |      "FALSE",then you cannot
    t values from tables =       2.447    |      say that they are
    (two tailed t test)  =      -2.447    |      statistically different
    (1/n1)+(1/n2)=  .5333333              |
qrt(1/n1)+(1/n2)=        0.73             |
qrt(pooled est.)=        0.48             |
-------------------------------------------
     calculated "t" value = .3534666      |
-------------------------------------------
**********************************************************************
**********************************************************************

GROUP A =CONTROL  PH                      |      null hypothesis is
         # OF OBS=          5             |      that group A = group B
         VARIANCE=  .0054999               |
         MEAN     =       7.81            |reject (calc > table) ?     FALSE
                                           |reject (calc < table) ?     FALSE
ROUP B =WELL 1    PH                      |
         # OF OBS=          5             |      if any "TRUE" values appear
         VARIANCE=       .037            |      then group A does NOT equal
         MEAN     =       7.87            |      group B statistically
-------------------------------------------
ooled estimator =  .0212500               |      if both conditions appear
egree of freedom=          8              |      "FALSE",then you cannot
    t values from tables =       2.306    |      say that they are
    (two tailed t test)  =      -2.306    |      statistically different
    (1/n1)+(1/n2)=          .4           |
sqrt(1/n1)+(1/n2)=       0.63             |
sqrt(pooled est.)=       0.15             |
-------------------------------------------
     calculated "t" value = -.650792      |
-------------------------------------------
**********************************************************************
```

```
**********************************************************************

GROUP A =CONTROL  PH                    |     null hypothesis is
         # OF OBS=          5           |     that group A = group B
         VARIANCE=  .0054999            |
         MEAN     =       7.81          |reject (calc > table) ?    FALSE
                                        |reject (calc < table) ?    FALSE
GROUP B =WELL 2   PH                    |
         # OF OBS=          5           |     if any "TRUE" values appear
         VARIANCE=       .018           |     then group A does NOT equal
         MEAN     =       7.79          |     group B statistically
-----------------------------------------
pooled estimator =  .0117500            |     if both conditions appear
degree of freedom=          8           |     "FALSE",then you cannot
    t values from tables =      2.306   |     say that they are
    (two tailed t test)  =     -2.306   |     statistically different
    (1/n1)+(1/n2)=          .4          |
sqrt(1/n1)+(1/n2)=       0.63           |
sqrt(pooled est.)=       0.11           |
-----------------------------------------
     calculated "t" value =  .2917306   |
-----------------------------------------
**********************************************************************
**********************************************************************

GROUP A =CONTROL  PH                    |     null hypothesis is
         # OF OBS=          5           |     that group A = group B
         VARIANCE=  .0054999            |
         MEAN     =       7.81          |reject (calc > table) ?    FALSE
                                        |reject (calc < table) ?    FALSE
GROUP B =WELL 3   PH                    |
         # OF OBS=          5           |     if any "TRUE" values appear
         VARIANCE=  .0129999            |     then group A does NOT equal
         MEAN     =       7.89          |     group B statistically
-----------------------------------------
pooled estimator =  .0092499            |     if both conditions appear
degree of freedom=          8           |     "FALSE",then you cannot
    t values from tables =      2.306   |     say that they are
    (two tailed t test)  =     -2.306   |     statistically different
    (1/n1)+(1/n2)=          .4          |
sqrt(1/n1)+(1/n2)=       0.63           |
sqrt(pooled est.)=       0.10           |
-----------------------------------------
     calculated "t" value = -1.31520    |
-----------------------------------------
**********************************************************************
**********************************************************************

GROUP A =CONTROL  PH                    |     null hypothesis is
         # OF OBS=          5           |     that group A = group B
         VARIANCE=  .0054999            |
         MEAN     =       7.81          |reject (calc > table) ?    FALSE
                                        |reject (calc < table) ?    FALSE
GROUP B =WELL 4   PH                    |
         # OF OBS=          2           |     if any "TRUE" values appear
         VARIANCE=  .1799999            |     then group A does NOT equal
         MEAN     =        7.5          |     group B statistically
-----------------------------------------
pooled estimator =  .0403999            |     if both conditions appear
degree of freedom=          5           |     "FALSE",then you cannot
    t values from tables =      2.571   |     say that they are
    (two tailed t test)  =     -2.571   |     statistically different
    (1/n1)+(1/n2)=          .7          |
sqrt(1/n1)+(1/n2)=       0.84           |
sqrt(pooled est.)=       0.20           |
-----------------------------------------
     calculated "t" value =  1.843413   |
-----------------------------------------
**********************************************************************
```

```
GROUP A =CONTROL  TDS                    |     null hypothesis is
         # OF OBS=         5             |     that group A = group B
         VARIANCE=     478.8             |
         MEAN     =     418.4             |reject (calc > table) ?    FALSE
                                          |reject (calc < table) ?    FALSE
GROUP B =WELL 1   TDS                    |
         # OF OBS=         5             |     if any "TRUE" values appear
         VARIANCE= 355.9999              |     then group A does NOT equal
         MEAN     =      422             |     group B statistically
-----------------------------------------|
pooled estimator = 417.4000              |     if both conditions appear
degree of freedom=         8             |     "FALSE",then you cannot
    t values from tables =      2.306    |     say that they are
    (two tailed t test)  =     -2.306    |     statistically different
    (1/n1)+(1/n2)=          .4           |
sqrt(1/n1)+(1/n2)=       0.63            |
sqrt(pooled est.)=      20.43            |
-----------------------------------------|
     calculated "t" value = -.278610     |
-----------------------------------------|
*****************************************|*****************************************
*****************************************|*****************************************

GROUP A =CONTROL  TDS                    |     null hypothesis is
         # OF OBS=         5             |     that group A = group B
         VARIANCE=     478.8             |
         MEAN     =     418.4             |reject (calc > table) ?    FALSE
                                          |reject (calc < table) ?    FALSE
GROUP B =WELL 2   TDS                    |
         # OF OBS=         5             |     if any "TRUE" values appear
         VARIANCE= 242.7998              |     then group A does NOT equal
         MEAN     =     432.4             |     group B statistically
-----------------------------------------|
pooled estimator = 360.7999              |     if both conditions appear
degree of freedom=         8             |     "FALSE",then you cannot
    t values from tables =      2.306    |     say that they are
    (two tailed t test)  =     -2.306    |     statistically different
    (1/n1)+(1/n2)=          .4           |
sqrt(1/n1)+(1/n2)=       0.63            |
sqrt(pooled est.)=      18.99            |
-----------------------------------------|
     calculated "t" value = -1.16537     |
-----------------------------------------|
*****************************************|*****************************************
*****************************************|*****************************************

GROUP A =CONTROL  TDS                    |     null hypothesis is
         # OF OBS=         5             |     that group A = group B
         VARIANCE=     478.8             |
         MEAN     =     418.4             |reject (calc > table) ?    FALSE
                                          |reject (calc < table) ?    FALSE
GROUP B =WELL 3   TDS                    |
         # OF OBS=         5             |     if any "TRUE" values appear
         VARIANCE= 847.1999              |     then group A does NOT equal
         MEAN     =     398.8             |     group B statistically
-----------------------------------------|
pooled estimator = 663.0000              |     if both conditions appear
degree of freedom=         8             |     "FALSE",then you cannot
    t values from tables =      2.306    |     say that they are
    (two tailed t test)  =     -2.306    |     statistically different
    (1/n1)+(1/n2)=          .4           |
sqrt(1/n1)+(1/n2)=       0.63            |
sqrt(pooled est.)=      25.75            |
-----------------------------------------|
     calculated "t" value = 1.203564     |
-----------------------------------------|
*****************************************|*****************************************
```

```
GROUP A =CONTROL  TDS                    |     null hypothesis is
        # OF OBS=          5             |     that group A = group B
        VARIANCE=      478.8             |
        MEAN     =      418.4             |reject (calc > table) ?    FALSE
                                          |reject (calc < table) ?     TRUE
GROUP B =WELL 4   TDS                     |
        # OF OBS=          3             |     if any "TRUE" values appear
        VARIANCE=   3761.333             |     then group A does NOT equal
        MEAN     =   492.6667            |     group B statistically
-----------------------------------------|
pooled estimator =  1572.978             |     if both conditions appear
degree of freedom=          6            |     "FALSE",then you cannot
    t values from tables =       2.447   |     say that they are
    (two tailed t test)  =      -2.447   |     statistically different
    (1/n1)+(1/n2)=   .5333333            |
sqrt(1/n1)+(1/n2)=        0.73           |
sqrt(pooled est.)=       39.66           |
-----------------------------------------|
     calculated "t" value = -2.56409     |
-----------------------------------------|
*****************************************|*****************************************
*****************************************|*****************************************

GROUP A =CONTROL  SP COND                |     null hypothesis is
        # OF OBS=          4             |     that group A = group B
        VARIANCE=   972.9167             |
        MEAN     =      588.75           |reject (calc > table) ?    FALSE
                                          |reject (calc < table) ?    FALSE
GROUP B =WELL 1   SP COND                |
        # OF OBS=          4             |     if any "TRUE" values appear
        VARIANCE=     2506.25            |     then group A does NOT equal
        MEAN     =      581.25           |     group B statistically
-----------------------------------------|
pooled estimator =  1739.583             |     if both conditions appear
degree of freedom=          6            |     "FALSE",then you cannot
    t values from tables =       2.447   |     say that they are
    (two tailed t test)  =      -2.447   |     statistically different
    (1/n1)+(1/n2)=          .5           |
sqrt(1/n1)+(1/n2)=        0.71           |
sqrt(pooled est.)=       41.71           |
-----------------------------------------|
     calculated "t" value =  .2543043    |
-----------------------------------------|
*****************************************|*****************************************
*****************************************|*****************************************

GROUP A =CONTROL  SP COND                |     null hypothesis is
        # OF OBS=          4             |     that group A = group B
        VARIANCE=   972.9167             |
        MEAN     =      588.75           |reject (calc > table) ?    FALSE
                                          |reject (calc < table) ?    FALSE
GROUP B =WELL 2   SP COND                |
        # OF OBS=          4             |     if any "TRUE" values appear
        VARIANCE=       2575             |     then group A does NOT equal
        MEAN     =      587.5            |     group B statistically
-----------------------------------------|
pooled estimator =  1773.958             |     if both conditions appear
degree of freedom=          6            |     "FALSE",then you cannot
    t values from tables =       2.447   |     say that they are
    (two tailed t test)  =      -2.447   |     statistically different
    (1/n1)+(1/n2)=          .5           |
sqrt(1/n1)+(1/n2)=        0.71           |
sqrt(pooled est.)=       42.12           |
-----------------------------------------|
     calculated "t" value =  .0419714    |
-----------------------------------------|
*****************************************|*****************************************
```

```
**********************************************************************

GROUP A =CONTROL  SP COND                 |      null hypothesis is
         # OF OBS=          4             |      that group A = group B
         VARIANCE= 972.9167               |
         MEAN    =    588.75              |reject (calc > table) ?    FALSE
                                          |reject (calc < table) ?    FALSE
GROUP B =WELL 3   SP COND                 |
         # OF OBS=          4             |      if any "TRUE" values appear
         VARIANCE= 972.9167               |      then group A does NOT equal
         MEAN    =    588.75              |      group B statistically
-------------------------------------     |
Pooled estimator = 972.9167               |      if both conditions appear
Degree of freedom=          6             |      "FALSE",then you cannot
    t values from tables =      2.447     |      say that they are
    (two tailed t test)  =     -2.447     |      statistically different
    (1/n1)+(1/n2)=          .5            |
Sqrt(1/n1)+(1/n2)=       0.71             |
Sqrt(pooled est.)=      31.19             |
-------------------------------------     |
     calculated "t" value =          0    |
-------------------------------------     |
**********************************************************************
**********************************************************************

GROUP A =CONTROL  SPEC COND               |      null hypothesis is
         # OF OBS=          4             |      that group A = group B
         VARIANCE= 972.9167               |
         MEAN    =    588.75              |reject (calc > table) ?    FALSE
                                          |reject (calc < table) ?    FALSE
GROUP B =WELL 4   SPEC COND               |
         # OF OBS=          3             |      if any "TRUE" values appear
         VARIANCE= 33058.33               |      then group A does NOT equal
         MEAN    = 681.6667               |      group B statistically
-------------------------------------     |
Pooled estimator = 13807.08               |      if both conditions appear
Degree of freedom=          5             |      "FALSE",then you cannot
    t values from tables =      2.571     |      say that they are
    (two tailed t test)  =     -2.571     |      statistically different
    (1/n1)+(1/n2)= .5833333               |
Sqrt(1/n1)+(1/n2)=       0.76             |
Sqrt(pooled est.)=     117.50             |
-------------------------------------     |
     calculated "t" value = -1.03534      |
-------------------------------------     |
**********************************************************************
**********************************************************************

GROUP A =CONTROL  PHENOL                  |      null hypothesis is
         # OF OBS=          2             |      that group A = group B
         VARIANCE=    7.2E-7              |
         MEAN    =     .0019              |reject (calc > table) ?    FALSE
                                          |reject (calc < table) ?    FALSE
GROUP B =WELL 1   PHENOL                  |
         # OF OBS=          3             |      if any "TRUE" values appear
         VARIANCE= 3.961E-5                |      then group A does NOT equal
         MEAN    = .0057333               |      group B statistically
-------------------------------------     |
Pooled estimator = 2.665E-5               |      if both conditions appear
Degree of freedom=          3             |      "FALSE",then you cannot
    t values from tables =      3.182     |      say that they are
    (two tailed t test)  =     -3.182     |      statistically different
    (1/n1)+(1/n2)= .8333333               |
Sqrt(1/n1)+(1/n2)=       0.91             |
Sqrt(pooled est.)=       0.01             |
-------------------------------------     |
     calculated "t" value = -.813471      |
-------------------------------------     |
**********************************************************************
```

```
**********************************************************************

GROUP A =CONTROL  PHENOL                 |     null hypothesis is
         # OF OBS=         2             |     that group A = group B
         VARIANCE=   7.2E-7             |
         MEAN    =     .0019            |reject (calc > table) ?    FALSE
                                        |reject (calc < table) ?    FALSE
GROUP B =WELL 2   PHENOL                |
         # OF OBS=         4            |     if any "TRUE" values appear
         VARIANCE=  .0019985            |     then group A does NOT equal
         MEAN    =   .035175            |     group B statistically
-----------------------------------------
pooled estimator =  .0014991            |     if both conditions appear
degree of freedom=         4            |     "FALSE",then you cannot
    t values from      2.776    3.182   |     say that they are
    (two tailed t test)  =     -3.182   |     statistically different
    (1/n1)+(1/n2)=        .75           |
sqrt(1/n1)+(1/n2)=       0.87          |
sqrt(pooled est.)=       0.04          |
-----------------------------------------
     calculated "t" value = -.992381    |
-----------------------------------------
**********************************************************************
**********************************************************************

GROUP A =CONTROL  PHENOL                 |     null hypothesis is
         # OF OBS=         2             |     that group A = group B
         VARIANCE=   7.2E-7             |
         MEAN    =     .0019            |reject (calc > table) ?    FALSE
                                        |reject (calc < table) ?    FALSE
GROUP B =WELL 3   PHENOL                |
         # OF OBS=         3            |     if any "TRUE" values appear
         VARIANCE= 5.563E-5             |     then group A does NOT equal
         MEAN    =     .0069            |     group B statistically
-----------------------------------------
pooled estimator =  3.733E-5            |     if both conditions appear
degree of freedom=         3            |     "FALSE",then you cannot
    t values from      2.776    3.182   |     say that they are
    (two tailed t test)  =     -3.182   |     statistically different
    (1/n1)+(1/n2)=  .8333333            |
sqrt(1/n1)+(1/n2)=       0.91          |
sqrt(pooled est.)=       0.01          |
-----------------------------------------
     calculated "t" value = -.896502    |
-----------------------------------------
**********************************************************************
**********************************************************************

GROUP A =CONTROL  TOX                    |     null hypothesis is
         # OF OBS=         4            |     that group A = group B
         VARIANCE=  .0015333            |
         MEAN    =       .07            |reject (calc > table) ?    FALSE
                                        |reject (calc < table) ?    FALSE
GROUP B =WELL 1   TOX                   |
         # OF OBS=         3            |     if any "TRUE" values appear
         VARIANCE=  .0016813            |     then group A does NOT equal
         MEAN    =  .0506667            |     group B statistically
-----------------------------------------
pooled estimator =  .0015925            |     if both conditions appear
degree of freedom=         5            |     "FALSE",then you cannot
    t values from      2.776    2.571   |     say that they are
    (two tailed t test)  =     -2.571   |     statistically different
    (1/n1)+(1/n2)=  .5833333            |
sqrt(1/n1)+(1/n2)=       0.76          |
sqrt(pooled est.)=       0.04          |
-----------------------------------------
     calculated "t" value =  .6343192   |
-----------------------------------------
**********************************************************************
```

```
GROUP A =CONTROL  TOX
        # OF OBS=          4
        VARIANCE=  .0015333
        MEAN     =       .07

GROUP B =WELL 2   TOX
        # OF OBS=          5
        VARIANCE=  .0622748
        MEAN     =     .2314
-------------------------------------
pooled estimator =  .0362427
degree of freedom=          7
    t values from      2.776     2.365
    (two tailed t test)   =     -2.365
    (1/n1)+(1/n2)=        .45
sqrt(1/n1)+(1/n2)=       0.67
sqrt(pooled est.)=       0.19
-------------------------------------
     calculated "t" value = -1.26382
-------------------------------------
```

```
        null hypothesis is
        that group A = group B

reject (calc > table) ?     FALSE
reject (calc < table) ?     FALSE

        if any "TRUE" values appear
        then group A does NOT equal
        group B statistically

        if both conditions appear
        "FALSE",then you cannot
        say that they are
        statistically different
```

```
GROUP A =CONTROL  TOX
        # OF OBS=          4
        VARIANCE=  .0015333
        MEAN     =       .07

GROUP B =WELL 3   TOX
        # OF OBS=          4
        VARIANCE=   .068918
        MEAN     =      .182
-------------------------------------
pooled estimator =  .0352257
degree of freedom=          6
    t values from      2.776     2.447
    (two tailed t test)   =     -2.447
    (1/n1)+(1/n2)=          .5
sqrt(1/n1)+(1/n2)=       0.71
sqrt(pooled est.)=       0.19
-------------------------------------
     calculated "t" value = -.843924
-------------------------------------
```

```
        null hypothesis is
        that group A = group B

reject (calc > table) ?     FALSE
reject (calc < table) ?     FALSE

        if any "TRUE" values appear
        then group A does NOT equal
        group B statistically

        if both conditions appear
        "FALSE",then you cannot
        say that they are
        statistically different
```

```
ROUP A =CONTROL  TOX
        # OF OBS=          4
        VARIANCE=  .0015333
        MEAN     =       .07

ROUP B =WELL 4   TOX
        # OF OBS=          3
        VARIANCE=   .000949
        MEAN     =      .045
-------------------------------------
ooled estimator =  .0012996
degree of freedom=          5
    t values from tables =      2.571
    (two tailed t test)   =     -2.571
    (1/n1)+(1/n2)=  .5833333
qrt(1/n1)+(1/n2)=       0.76
sqrt(pooled est.)=       0.04
-------------------------------------
    calculated "t" value =  .9079880
-------------------------------------
```

```
        null hypothesis is
        that group A = group B

reject (calc > table) ?     FALSE
reject (calc < table) ?     FALSE

        if any "TRUE" values appear
        then group A does NOT equal
        group B statistically

        if both conditions appear
        "FALSE",then you cannot
        say that they are
        statistically different
```